

IN THE CLAIMS:

1 1. (Currently Amended) A gerotor and bearing apparatus for a downhole whirling mass
2 orbital vibrator generating vibration in a borehole, which apparatus comprises:

3 a gerotor with an inner gear rotated by a shaft having one less lobe than an outer gear;

4 a whirling mass attached to said shaft;

5 ~~at least one~~ an upper track roller bearing attached to said shaft engaging and rolling
6 on an upper ~~at least one~~ sleeve; and

7 a lower track roller bearing attached to said shaft engaging and rolling on a lower
8 sleeve; and

9 means to rotate said inner gear, said mass, and said ~~bearing~~ bearings in a selected
10 rotational direction to cause said mass, said inner gear and said ~~bearing~~ bearings to backwards whirl
11 in an opposite rotational direction.

1 2. (Canceled) A gerotor and bearing apparatus as set forth in Claim 1 wherein said
2 bearing is a track roller bearing.

1 3. (Canceled) A gerotor and bearing apparatus as set forth in Claim 1 including a pair
2 of bearings attached to said shaft engaging a pair of sleeves.

1 4. (Currently Amended) A gerotor and bearing apparatus as set forth in Claim 3
2 wherein said ~~pair of~~ bearings and said ~~pair of~~ sleeves are replaceable.

1 5. (Currently Amended) A gerotor and bearing apparatus as set forth in Claim 3 1
2 wherein said bearings are on opposite ends of said whirling mass.

1 6. (Original) A gerotor and bearing apparatus as set forth in Claim 1 wherein said
2 means to rotate said inner gear, said mass, and said bearing in a selected rotational direction includes
3 a drive shaft with a plurality of U-joints.

1 7. (Currently Amended) A gerotor and bearing apparatus as set forth in Claim 1
2 including a fluid pump powered by said shaft providing a self-contained drip lubrication system
3 having a fluid pump moving lubricating oil from an oil sump.

1 8. (Original) A gerotor and bearing apparatus as set forth in Claim 7 including a pair
2 of U-joint assemblies.

1 9. (Original) A gerotor and bearing apparatus as set forth in Claim 1 including a pair
2 of said gerotors spaced from each other and coaxially aligned.

1 10. (Original) A gerotor and bearing apparatus as set forth in Claim 1 wherein said
2 backwards whirling mass is an elongated cylinder.

1 11. (Original) A gerotor and bearing apparatus as set forth in Claim 1 wherein said
2 backwards whirling mass produces vibration energy which is used in enhanced fluid recovery.

1 12. (Original) A gerotor and bearing apparatus as set forth in Claim 1 wherein said
2 backwards whirling mass produces vibration energy which is used as a seismic source.

1 13. (Original) A gerotor and bearing apparatus as set forth in Claim 1 wherein said
2 backwards whirling mass is an elongated cylindrical configuration with a diameter less than said
3 housing.

1 14. (Original) A gerotor and bearing apparatus as set forth in Claim 1 wherein said inner
2 gear backwards whirl at a speed defined by a factor

$$K = \frac{n}{N-n} \quad \text{where } n = \text{number of lobes on inner rotor and} \\ N = \text{number of lobes on outer rotor}$$

1 15. (Currently Amended) A method to generate vibrational energy in a borehole, which
2 method comprises:

3 rotating an inner gear of a gerotor by a shaft in a selected rotational direction wherein
4 said inner gear has one less lobe than an outer gear;

5 rotating a whirling mass in a selected rotational direction by rotation of said shaft so
6 that said mass and said inner gear backwards whirl in a direction opposite to said selected rotational
7 direction; and

8 transmitting centrifugal force created by said whirling mass from ~~at least one~~ an
9 upper bearing to at least one an upper cylindrical sleeve and from a lower bearing to a lower
10 cylindrical sleeve by contacting and rolling on said sleeve sleeves.

1 16. (Original) A method to generate vibrational energy in a borehole as set forth in
2 Claim 15 including transmitting said centrifugal force to a downhole casing.

1 17. (Original) A method to generate vibrational energy in a borehole as set forth in
2 Claim 15 wherein said centrifugal force generates vibrational energy.

1 18. (Canceled) A method to generate vibrational energy in a borehole as set forth in
2 Claim 15 including contacting a sleeve with at least one bearing rotated by said shaft.

1 19. (Currently Amended) A method to generate vibrational energy in a borehole as set
2 forth in Claim 15 including transmitting said centrifugal force from said ~~sleeve~~ sleeves to slips and
3 to a casing.

1 20. (Currently Amended) A gerotor and bearing apparatus for a downhole whirling mass
2 orbital vibrator generating vibration in a borehole, which apparatus comprises:

3 a pair of gerotors spaced from each other, each gerotor with an inner gear rotated by
4 a shaft having one less lobe than an outer gear;

5 a whirling mass attached to said shaft;

6 a pair of track roller bearings attached to said shaft on opposite ends of said whirling
7 mass;

8 means to rotate said inner gears, said mass, and said bearings in a selected rotational
9 direction to cause said gears, said mass, and said bearings to backwards whirl in an opposite
10 rotational direction so that said track roller bearings roll on cylindrical sleeves; and

- 11 means to maintain angular radial position and angular alignment between said ends
- 12 of said rotating mass.